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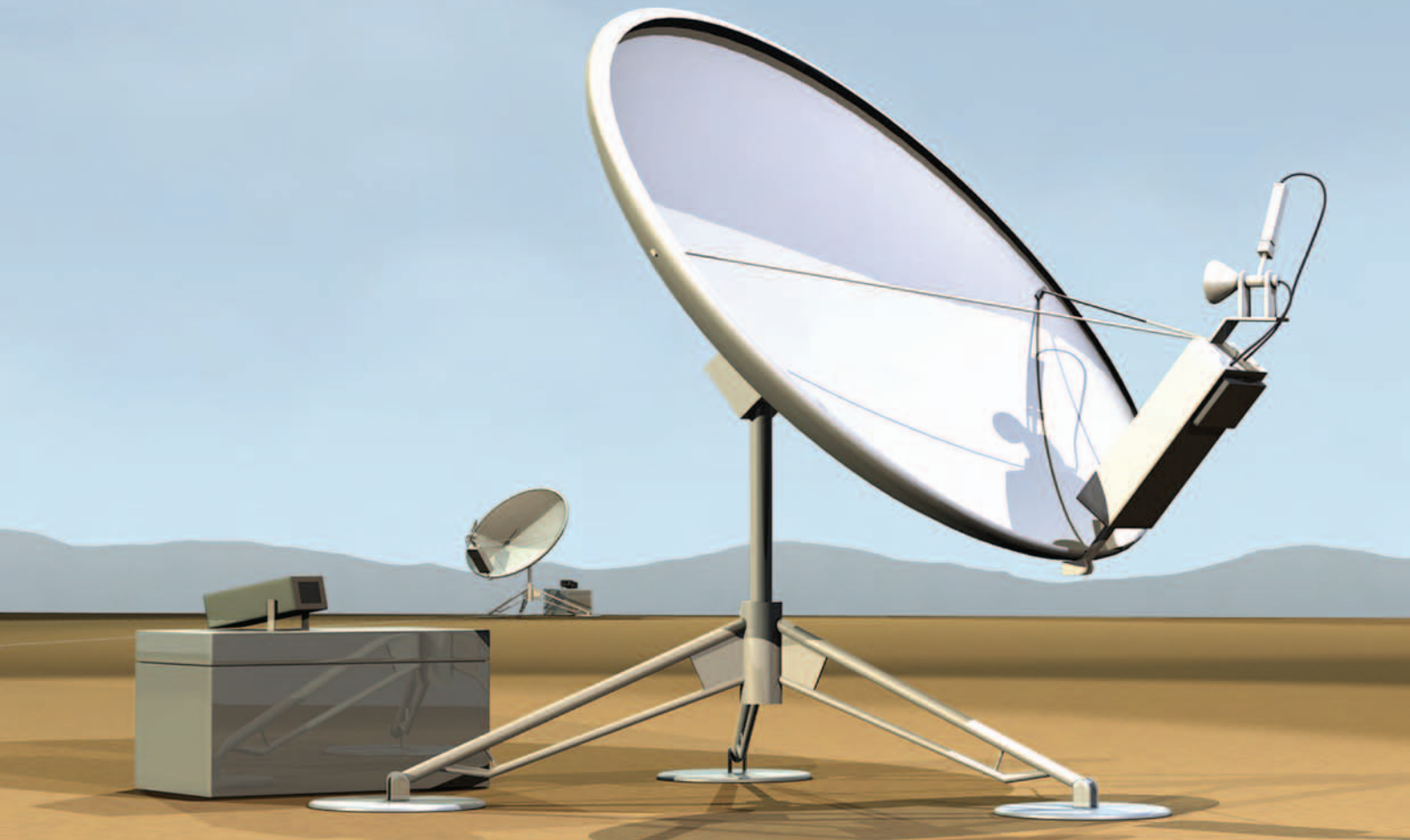

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CONTENTS

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The Defence Science and Technology Organisation (DSTO) is part of the Department of Defence and provides scientific advice and support to the Australian Defence Organisation. DSTO is headed by the Australian Chief Defence Scientist, Dr Roger Lough, and employs about 2100 staff, including some 1300 researchers and engineers. It is one of the two largest research and development organisations in Australia.

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Fuel test kits protect RAAF aircraft

DSTO has recently developed a fuel test kit to detect an additive that can seriously compromise RAAF bulk fuel handling. The +100 additive is known to rapidly disarm fuel coalescing filters used for preventing the transmission of water and particulate material into RAAF aircraft during fuelling.

DSTO researcher Paul Rawson explains the reason why the fuel additive (which is favoured by US military aircraft) is used in the first place – to improve the capacity of a fuel to cope with heat loads, known as aircraft fuel thermal stability.

"As well as providing energy for propulsion, aviation fuel also acts as a heat sink that cools the engine. As engines become more powerful, the heat load demand on the fuel increases.

"Fuel, when subjected to high temperatures tends to form deposits that reduce engine efficiency, causing augmenter and main burner anomalies as well as damage that impacts on maintenance requirements and operational readiness. To increase thermal stability by 100ºF, the USAF has developed this fuel thermal stability additive, commonly known as the +100 additive."

Australia has not yet adopted the +100 additive for use with ADF gas turbine aircraft, but DSTO has completed extensive laboratory and combustion rig trials that prove the effectiveness of the additive's properties to improve thermal stability and its detergent action in reducing the formation of thermal deposits and in cleaning off those that have already formed.

The increasing incidence of the problem

USAF aircraft landing at Australian bases often have to be de-fuelled as well as re-fuelled.

Because the +100 additive disarms the fuel filter coalescer units used at all RAAF bulk fuel installations that prevent the transfer of dirt and water onboard RAAF aircraft, all fuel taken from US aircraft must be tested before storage in RAAF tankage.

Fuel that does contain the +100 additive cannot be de-fuelled into RAAF tanks; instead it must be disposed of, isolated or diluted one hundred fold.

The increase in US air traffic in Australia, such as heavy-lift aircraft using RAAF Base Richmond, and USMC F-18 aircraft recently participating in exercise Operation Southern Frontier from RAAF Base Townsville, has highlighted the need for a widely available field test kit for use by RAAF personnel to detect the +100 fuel additive.

The DSTO-developed field test kit

In response to this problem, the DSTO fuels team developed a field test kit based on a US version that gives RAAF operators a tool for detecting the +100 additive at harmful concentrations, allowing for informed management of the fuel during the de-fuelling process.

The test kits are currently being evaluated by RAAF staff at Townsville, and in the near future will be issued to RAAF Richmond for trial and evaluation. Joint Fuels and Lubricants Agency, part of the Defence Materiel Organisation, is in the process of validating the field kits performance as a simple yes/no analysis tool. The expectation is that the kits will be deployed to operational bases soon.

DSTO is also researching alternate technologies for a field kit to detect the +100 additive at reduced concentrations to assist base staff in dilution of the +100 additive.

Faster cholera test

DSTO microbiologist Ania Gubala has developed a test which can rapidly detect the bacteria that causes potentially deadly cholera outbreaks. Her achievement was recognized by the Australian Society for Microbiology in the form of a first place poster award given at its annual national conference held in Sydney last September.

The problem at the focus of her work, the *Vibrio cholerae* bacteria, causes life-threatening diarrhea when contaminated food or water is consumed. Other symptoms include vomiting, abdominal cramps and shock after severe dehydration through fluid and electrolyte loss.

Cholera outbreaks are endemic to many parts of the world and are known to occur as a result of natural disasters such as earthquakes and floods. The incidence of the problem worldwide is estimated to be in the millions, almost entirely in developing countries. Many of these regions are deployment zones for ADF personnel.

In order to treat the condition, firstly medical staff need to establish the presence of the bacterium – and time is of the essence.

Identification techniques

Traditional identification techniques through culturing of the bacteria can take one to two days. A faster way of doing so is a process known as a real-time polymerase chain reaction (PCR).

This enzymatic reaction utilises rapid thermal cycling to amplify specific target DNA sequences that are then readily detectable using fluorescent dyes. To ensure that only the target DNA is amplified, short synthetic pieces of DNA are used to prime the reaction.

"Using this technique of amplifying specific DNA from the bacteria," explains Gubala, "we can detect the presence of very low numbers of bacterial cells present in a sample. The real-time PCR process has become widely used to detect many different bacteria, and has been successfully applied by DSTO scientists to provide detection of other potential bio-warfare agents."

A better test for speed and specificity

Gubala's particular contribution in this area was the development of a multiplex real-time PCR assay that can detect up to four different genes (which are unique to *V. cholerae*) within 60 minutes; faster than other assays and the first to detect four targets of *V. cholerae* in a single real-time PCR reaction.

The ability to detect more than one gene in a single reaction provides increased specificity, enabling differentiation of *V. cholerae* from other non-disease causing Vibrio species. The combination of speed and high specificity of detection makes the DSTO assay extremely reliable in correctly identifying the organism.

The assay was developed using the Cepheid SmartCycler apparatus, an instrument designed for easy transportability and could therefore be used in the field during ADF deployments when quick detection of cholera may be necessary.

The rapid diagnostic assay took 12 months to develop as part of a task for medical defence against chemical and biological agents. Currently, the assay is undergoing refinement using an alternative method of detecting the amplified DNA. This approach uses fluorescently labelled short synthetic pieces of DNA that bind to the target DNA. The hope is to increase the sensitivity of the assay so that even fewer bacteria can be detected in a given sample.

"This is important if we are monitoring for the deliberate releases of biological agents, which may occur at low concentrations but still be capable of causing disease," says Gubala.

Other development plans include a thorough evaluation of the assay for detecting *V. cholerae* from environmental samples such as drinking water or sea water to determine the efficiency of the assay when inhibitory substances are present in these samples.

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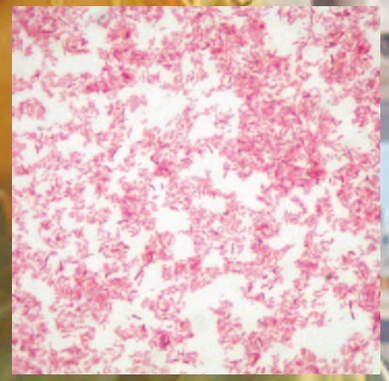
I'm thrilled that my work has been recognised by my peers and pleased that it will make a real contribution to Defence.

- Ania Gubala, winner of Australian Society for Microbiology poster prize



Using heat and smoke as a place to hide

Smoke obscuration in the visual region has been used by the military for many years to gain battlefield advantages of concealment and protection. DSTO researchers have been involved in trials this year to evaluate the performance and effectiveness of new types of vehicle-deployed 76 mm smoke munitions that provide effective cover in the thermal region of the spectrum.

Dr Ken Smit explains the background to the research. "Thermal imagers in the 8 to 14 micrometer region of the electromagnetic spectrum – the far-infrared – can visualise terrain and targets unimpeded through most smokes. As far back as the first Gulf War in 1991, Coalition forces used advances in thermal imagery to engage enemy forces in Kuwait through the thick smoke from oil-fuelled fires started by Iraqi forces."

"The smoke munitions we trialled use red phosphorus pyrotechnic compositions that produce heat during combustion and subsequent smoke hydrolysis. The heat produced in the smoke masks the heat produced by the vehicle, obscuring it to the thermal sensor."

Dr Damian Hall, carrying out research with a focus on heat signature management, says, "The use of smoke obscurants to mask Army vehicles can be enhanced if suitable infrared camouflage is also employed on the vehicle, reducing a vehicle's visibility to thermal sensors. Thermal camouflage and other signature management techniques will increasingly be required by Army for their platforms."

The trials

A trial was undertaken in April 2004 at Puckapunyal with the assistance of the Land Warfare Development Centre, and the School of Armour. The platforms being tested were the Leopard main battle tank and the Australian light armoured vehicle ASLAV-25, both of which have two multi-barrel smoke grenade dischargers on their turrets, one on each side.

DSTO researchers worked on a range of aspects during the April trial, collecting visual and thermal imagery of the vehicles, and evaluating particular aspects of ASLAV-25 infrared camouflage. The smoke grenades were tested in various conditions for deployment with successful outcomes being recorded.

A second trial, included as a countermeasures component of a major trial, was carried out at Mt Bundey in the Northern Territory in October 2004 with the support of 2nd Cavalry Regiment and 161 Reconnaissance Squadron. The trial evaluated the performance of a red phosphorus based smoke grenade against a range of in-service systems.

The advantages of red phosphorous

According to Dr Smit, red phosphorus munitions are considered far preferable to those based on hexachloroethane (HC), a former ADF vehicle-deployed visual obscurant, because of their better OH&S characteristics and their effectiveness against thermal imagers.

In considering environmental impacts, the phosphoric acid based smoke produced has very low toxicity and is rapidly environmentally degraded.

Red phosphorus compositions also have advantages over those of white phosphorus, being more benign and stable than the highly toxic and spontaneously combustible white variety.

"However, red phosphorus based countermeasures do need to be stored appropriately, and suitable monitoring of phosphine gas formation is required," says Dr Smit. "We in Australia are benefiting from collaborative research projects with the USA and UK aimed at understanding the chemical ageing mechanism of red phosphorus based pyrotechnic compositions."

Australian DEFENCESCIENCE

Maritime Applications

In addition to the possible application of these smoke munitions to protect Army vehicles, 130 mm naval countermeasures using red phosphorus are planned for the defence of Royal Australian Navy FFG frigates from heat seeking anti-ship missiles. Ian Buttery, a key DSTO researcher in this field, says, "Red phosphorous based countermeasure munitions are as important at sea as on land."

UAV eyes support networked users

A series of research activities organised by DSTO's Automation of Battlespace Strategic Initiative came together at Woomera last September to test and demonstrate a range of semi-autonomous to fully autonomous systems, and to participate in a Network Centric Warfare scenario jointly investigated with the US Army under Project Arrangement 10 (PA 10).

One of the technologies under review was a video pan/tilt/zoom device developed collaboratively with Tenix Pty Ltd. Mounted centrally in an Aerosonde Unmanned Aerial Vehicle (UAV), it was designed to provide real-time video surveillance data.

The unit, weighing less than three kilograms, provided 40 degrees of movement in roll and 180 degrees of movement in pitch. It was also inertially stabilised to remove most of the unwanted aircraft movement. The payload could carry either of two Sony cameras with 18X or 25X optical zoom, and allowed all camera functions to be controlled remotely during the flights.

The results of the flight trial were an outstanding success. From altitudes of almost 2 kilometres, operators were able to zoom in on various targets, monitor people and small Unattended Ground Vehicle (UGV) movements.

Another of the video systems being tested provided geo-location of ground targets observed through a UAV-mounted video camera in order to cue the missions of UGVs. The UAV flew over pre-surveyed markers on the ground, one of which was designated as the target.

UAV eyes for UGVs

The imagery and attitude data gathered on the flight were transmitted to a ground station where it was automatically interpreted, using the UAV's GPS position, altitude, and attitude, and the position of the target within the picture, to generate a GPS target location. This information was then stored and superimposed on a map generated from an aerial photo, and compared with the true surveyed locations.

DSTO researcher Jean-Pierre Gibard says, "Having proved the pan/tilt/zoom and the geo-location capabilities separately, the next step is to integrate them into a single system."

In the ground phase of the trial, three types of UGVs were used. Each type was initially allocated an area in which to test basic navigation and system checks. Later in the week, a route file based on information gathered by the UAV was generated and given to each group, which then tasked their respective UGVs to navigate a course to the target and return to base.

All the UGVs were successful in making their way to the target and back. One of the UGVs, cued with processed data from the UAV video feed, found its way to the detected threat, and thereby demonstrated a capability to operate successfully under real-time data transfer conditions.

The power of networked distributed sensors

Another series of experiments showed how detections of radar emitters by networked Electronic Support (ES) sensors carried by three Aerosonde UAVs could be used to cue a networked video sensor carried on another Aerosonde to gain imagery of the emitter. Streaming video from the UAV was available in real-time to users at DSTO Edinburgh viewing hand held devices.

An ES system consists of several sensing subsystems; these include one subsystem that monitors a wide band of spectrum for radar signal activity to quickly cue another that gives precision measurement of the characteristics of the signal. DSTO's research in recent years has looked at the relative advantages of distributing ES components over several UAVs rather than aggregating them into one aircraft.

Dr Kim Brown explains, "Evaluating the tradeoffs involved in these options is a complex process. With significant payload constraints on what an UAV can carry, the trials we conducted indicate that distributing ES system components over multiple UAVs is a viable option."

"One benefit of this approach is that a distributed ES system gives more information about the source radar position than a single platform system. A consequence, however, is increased complexity of sensor control, signal processing, inter-platform communication and platform control. This trial has shown that the complexity is manageable by using novel autonomous control algorithms leveraging concepts used by swarming biological systems."

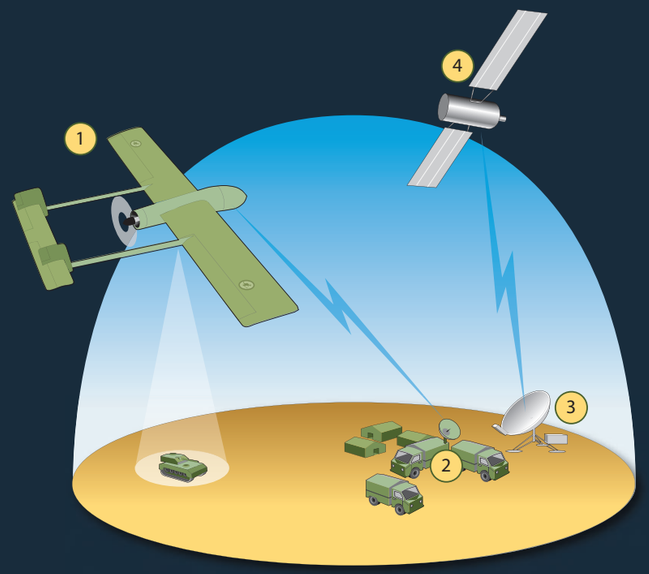
Fort Dix virtual experiment

In another series of trials, data from ES sensors at Woomera was made available via a web service to users at Fort Dix in New Jersey as part of the annual C4ISR On The Move experiment of the US Army's Communications, Electronics Research, Development and Engineering Center (CERDEC). The data path included a satellite communications link from Woomera to Adelaide provided by DSTO using the Secure Satellite IP Network (SSATIN).

US Army staff at Fort Dix were able to fly an Aerosonde carrying a video camera over a target using ES detections and streaming video disseminated via the Internet. This data was also made available to the command support environment for C4ISR On The Move. Coordinates for the UAV missions were mapped onto the Fort Dix precinct where the 2004 C4ISR On The Move exercise was taking place so that entities at Woomera became virtual participants in the experiment.

US response to the demonstration was very positive, with an agreement obtained for Aerosondes with electronic support, video and electronic attack payloads to fly in the USA and demonstrate a System of EW Systems capability at the C4ISR On the Move experiment in 2005.

"DSTO, through its Automation of Battlespace Strategic Initiative program, is focused on addressing a number of strategic challenges facing Australia," says Dr Nanda Nandagopal. "It has now successfully demonstrated autonomous operations involving UAVs with UGVs and their command and control from North America via satellite. This is only the beginning. DSTO participation in the C4ISR On The Move experiments is an important step in the development of a new joint research program with the major US defence research agencies."



1. Unmanned Aerial Vehicle (UAV) transmits real time video surveillance data
2. UAV transmission is received by a mobile ground station where it is interpreted
3. Secure Satellite IP Network (SSATIN) provides a satellite conection
4. Communication centres in Australia and North America receive streaming data and video via the internet

DSTO's secure satellite internet protocol (SSATIN) network

DSTO is developing a satellite network facility that could offer future military users access-on-demand and bandwidth-on-demand with military grade security using the OPTUS C1 satellite. The dynamic system will allow better utilisation of OPTUS C1 by offering more responsive services based on user requirements, supporting a larger terminal population with higher traffic volumes, and providing savings in management and personnel overheads.

DSTO conducted the first trials of SSATIN at Woomera in September last year in association with the Automation of Battlespace Initiative. The goals of the trial were to validate the SSATIN probing and ranging algorithms under field conditions, test the bandwidth-on-demand allocation algorithms and deliver live video and metadata feeds from an Aerosonde UAV to US Army CERDEC. All operations were conducted successfully.

US responses were that the exercise was of great value, in particular, data obtained about the HTML feed over IP. The trial was also instrumental in enabling DSTO researchers to clarify requirements for improved SSATIN network control, development of better data traffic test methods and improvements in modem hardware.

A better way of **sub spotting in flight**

DSTO is working with CSIRO on a new way of locating and identifying submarines from the air.

A $3 million Defence Capability & Technology Demonstrator (CTD) contract now forms part of CSIRO's $7 million project to develop a novel magnetic anomaly detector system called MAGSAFE.

MAGSAFE builds on the team's decade-long experience of applying Superconducting Quantum Interference Device (SQUID) technology to geo-prospecting, harnessing the power of superconductors to detect subtle changes in the Earth's magnetic field.

"Current Magnetic Anomaly Detection (MAD) systems use total field magnetometers which require complex compensation for noise, and do not offer a vector – a directional indicator – for a contact, only a range," says DSTO researcher Dr Alan Theobald.

"MAGSAFE employs three detectors that will theoretically enable operators to tell the range, depth and bearing of a sub, as well as where it's heading, how fast it's going and whether it's diving," he explains.

Rotating gradiometer

The key element in MAGSAFE, according to Keith Leslie who oversees the technical side of the project at CSIRO, is known as a rotating gradiometer.

"To measure a gradient, you'd usually hold a couple of sensors and separate them, but if you do that with SQUIDS you end up with what's known as an offset problem," he explains. "The way around this is to rotate the pair of SQUIDS."

In a neat simplification of this idea, the team creates the same effect with one SQUID by having it circle a flexible strip of superconducting material. "The tape acts almost like an antenna – and a very sensitive one at that," says Leslie.

Being so finely tuned to detecting magnetic flux means that these SQUIDs are more readily able to tell signal from noise. This is very important when sub-spotting because even the ocean swell produces variations in the magnetic field.

Dr Cathy Foley, Head of CSIRO's SQUID research says, "Collecting information across three dimensions means MAGSAFE could also be used to 'map' the target – a bit like playing a 3-D version of the game Battleships. If we can see the shape, we're pretty sure we may be able to determine the type."

Implications for defence

Not only does the MAGSAFE system offer superior vector and source strength information about a target, the greater sensitivity of the system also means that patrol aircraft need not fly as low as they do using conventional MADs.

"In theory, they should only need one fly-past to spot a target," says Dr Foley. "What's more, because we're measuring in 3-D, we can look at a target on an angle, so the plane doesn't have to be directly overhead."

Being able to fly at a greater altitude may reduce the airframe stress, a major cost-driver for military platforms, as well as reducing the risk from sub-surface to air weapons.

Over the next three years, DSTO and CSIRO will be working closely to benchmark existing technology and verify MAGSAFE's capabilities.

Nic Svenson

Australian DEFENCESCIENCE

There's an awful lot we don't know yet, but industry is already clamouring at our door because our theoretical predictions are quite revolutionary.

- Dr Cathy Foley, CSIRO

Sharper eyes for **surveillance operators**

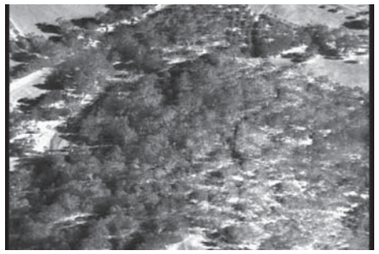
New imaging technology developed by DSTO has demonstrated a potentially efficient way of carrying out surveillance operations over land environments. Video Moving Target Indication (VMTI) renders moving vehicle targets that are difficult to see with the unaided eye highly conspicuous to human surveillance analysts working with the system. DSTO's system shows promise of reliably doing so at lower magnifications than any others of its kind, thus allowing broader ground coverage during surveillance missions.

Aircraft undertaking surveillance often operate over cluttered environments that frequently obscure a moving target to airborne observers. Furthermore, the electro-optic video cameras used for airborne surveillance are operated with a wide field of view to gain maximum ground coverage, meaning that any targets present will be very small and extremely difficult to see.

VMTI technology is a computer processing method that offers assistance to surveillance analysts by processing surveillance video in a way that highlights moving targets and suppresses background clutter.

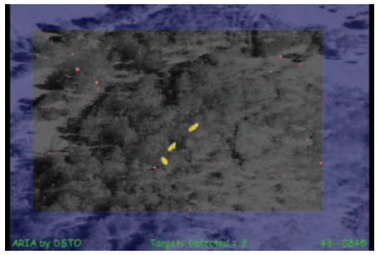
DSTO researcher Dr Robert Caprari describes the basic process involved. "Take two video frames separated by some small time interval; bring them into registration with each other; subtract them to cancel out the background and leave peaks where there has been movement between the two frames; examine the residual peaks to decide if they are substantial enough to label as targets; and display the results."

Stationary targets are not detectible at all by VMTI because there is no anomalous motion that would create a signature.



View of terrain before VMTI visualisation

> *If VMTI is developed for operational use, it would significantly help military aircraft on tactical missions to prosecute or defend against hostile ground vehicles.*
>
> - Dr Robert Caprari



View of terrain after VMTI visualisation

VMTI will only work over land environments, because the process requires that the stationary background be recognisable as the same from frame to frame as the field of view flows along. For this reason, VMTI technology is not usable at sea where the background consists of a generally featureless and ever-changing surface.

DSTO's VMTI process

The DSTO VMTI system enhances the basic VMTI process by adding an aggressive clutter suppression stage to the basic processing chain described above. The VMTI display consists of a two-level overlay on the video frames.

Detections of movement identified by the VMTI algorithm are presented on the display as red pixels of varying intensity. While imperfections in VMTI computations lead to clutter scintillation, the VMTI signature of a moving target is so distinctive that a human observer has no trouble distinguishing between the two. As such, the basic VMTI overlay very effectively serves as a cueing mechanism in a human-in-the-loop surveillance system.

The VMTI system applies a second algorithm that makes an autonomous decision about the presence or absence of a target from the basic detections. Targets identified by this algorithm are identified to the operator by a yellow overlay. An alarm may also be triggered to alert the aircrew.

The next step after detection is for a human operator to zoom in on the target for identification and decide upon appropriate action. While not obviating the need for human operators, Automatic Target Detection clearly does enable the operator to perform better with less effort.

An impressive performance

DSTO trials on its VMTI system were carried out with vehicle targets that were often obscured by foliage, and a computer implementation that was not optimised for speed.

Even so, when using an operator to manually verify detections, targets were conspicuous for more than three quarters of the time, and clutter was never mistakable for real targets. When operating in a fully automated target detection mode, targets were detected for more than half the time they were exposed, with a very low false alarm rate.

Target cueing and detection statistics such as these are more than satisfactory for operational requirements, considering the difficulty an unaided human observer would have following targets in the trials video.

The DSTO VMTI system is at proof-of-concept stage in its development, and is presently far from achieving real-time operation. Further trials need to be conducted to verify its performance.

Naval gunfire support trial **points to networked future**

During ADF operations, RAN ships are often called upon to provide gunfire support for engagements on land. DSTO researchers recently carried out a trial to investigate the differences in effectiveness of naval gunfire support (NGS) when using a new data connection in place of a traditional voice connection.

Army operative for voice-connected NGS.

The experiment, involving several key elements of network centric warfare, was conducted in a virtual environment at the Maritime Experimentation Laboratory at DSTO as part of the Navy Innovation Strategy's Experimentation program.

Two Army teams and two Navy teams participated in the experiment. Each Navy NGS team comprised a Principal Warfare Officer, Navigator, Fire Control Officer, and an Action Picture Supervisor. Each Army team comprised a Forward Observer and a Signaller. The Navy teams used an Anzac Combat Management System (CMS) embedded in a simulation environment to respond to Army's calls for fire.

DSTO researchers conducted the experiment to investigate differences between conventional voice-connected NGS and data-connected (networked) NGS in a 'target of opportunity' scenario where target coordinates are not known in advance. It was expected that NGS would be made faster by automating the translation of Military Grid Reference System (MGRS) coordinates to latitude and longitude coordinates, and by injecting targeting and adjustment information directly into the ship's combat system.

Voice connected versus data connected mode

In voice-connected mode the Army team made calls for fire using NATO standard procedures. In the data-connected mode, the Army team transferred targeting information using a modified Battlefield Command Support System (BCSS) that directly passed and injected target details into the Anzac CMS without voice connection. In addition to this experiment, a second voice mode was investigated in which Army's MGRS coordinates could be typed directly into the CMS without the Navigator needing to translate them to latitude and longitude.

Saab Systems, the manufacturers of the Anzac CMS and BCSS provided the data connection between enhanced versions of these two systems under a DSTO-Saab Interactive Project Agreement. DSTO staff created a virtual environment around these systems to place the Navy and Army teams into geographic locations for the conduct of the NGS missions.

The teams conducted more than 120 NGS missions over four days of experiments. Three 'virtual' geographic locations were used: Beecroft, Lancelin and Townshend Island.

The recording of events and other data allowed analysis of timing differences and errors between experiment modes (voice, voice with MGRS, data). Measures of secondary task reaction time and questionnaires were used to assess workload differences between modes.

Outcomes

As expected, the data-connected NGS reduced the size of the errors, the workload and the time taken by Navy to achieve its part of the mission. However, for Army operations, the data mode took longer than the two voice modes because the process of entering information into the BCSS was more time-consuming. The net result was that mission times were greater for the data mode than voice modes.

New DSTO maritime research capability at HMAS Stirling

A $3 million extension to DSTO's Stirling research facility has recently been completed to enhance its provision of leading edge support to the Royal Australian Navy in specialised submarine research.

The newly expanded structure, located at HMAS Stirling in Rockingham, south of Perth, can now accommodate up to 70 staff, with four new research laboratories focusing on Materials Investigation, Noise and Vibration, Combat Systems, and Sonar Processing.

These developments are expected to boost a variety of core research programs, like that of submarine hull and towed sonar data replay and analysis, which are critical in evaluating submarine sonar performance and investigating advanced processing concepts.

The extensions also provide DSTO researchers with a replica of a Collins Class submarine control room for the study of interactions between systems and operators, improved computer based facilities for modelling studies and submarine tactical war games, an expanded trials support capability, and a better ability to undertake materials failure analysis and data-mining activities.

Armchair Warrior 4 advances AEW&C capability

A week-long exercise titled Armchair Warrior 4 was held at the beginning of last September at RAAF Base Williamtown in the new 2 SQN HQ Building to ready the yet-to-be-delivered Airborne Early Warning and Control (AEW&C) air asset for service.

The AEW&C Boeing 737-based aircraft will enter service in the 2006-07 timeframe, to be used primarily for Airborne Surveillance and Battlespace Management.

The Armchair Warrior series of crew-in-the-loop simulation exercises have been designed to assist 2SQN in the development of tactical procedures for use in the AEW&C System in advance of aircraft being delivered under Project Wedgetail.

The first two exercises were broadly focused on Air Defence and Force Coordination, while Armchair Warrior Three had a focus on coordination with Civilian Agencies such as Coast Watch and Australian Search and Rescue (AusSAR).

'AW4 exercise under way at RAAF Williamtown'

The objective of the recent exercise was to conduct a force coordination simulation to assist 2SQN develop and validate Wedgetail Tactical Procedures in the areas of strike support, land support, special operations support, reconnaissance support, and multi AEW&C handover/takeover procedures.

In the lead-up to AW4 exercise a number of critical activities were undertaken in the newly established Melbourne node of the Aerospace Battlelab Framework at DSTO, Fishermans Bend. This included development and system testing of the Wedgetail Capability Modelling Environment (WCME), a BattleModel-based simulation being developed by KESEM International under contract to the AEW&C Systems Project Office.

Magnetic mapping trial of a Collins Class submarine

A magnetic survey of a Collins Class submarine was recently carried out by DSTO personnel at HMAS Stirling in support of the development of a Closed Loop Degaussing (CLDG) system.

The CLDG system consists of a large number of magnetometers installed both inside and outside the submarine pressure hull to monitor changes in magnetisation caused by deep diving or attitude changes. These detections are then fed into an electrical system that minimises the submarine's magnetic signature at any heading and depth and at any location in the world.

The first objective of the trial was to find suitable locations for the onboard magnetic sensors sufficiently distant from the DG coils to avoid saturation during operation.

The submarine HMAS Rankin was used as the trial vessel. With assistance from the boat's crew and the newly created Trials Group Submarine, the entire submarine was magnetically surveyed in two days.

CALENDAR

13 - 16 Feb 2005	Decon Downunder Melbourne http://www.dsto.defence.gov.au/corporate/conferences/decondownunder/home.html
14 - 16 Feb 2005	Artificial Intelligence and Applications Innsbruck, Austria Email: calgary@iasted.org
22 - 23 Feb 2005	ADM 2005 2nd annual congress Canberra www.informa.com.au/adm2005
25 Feb 2005	3rd National Engineering Security Research Forum Australian Defence Forces Academy, Canberra, Australia http://www.safeguardingaustralia.org.au/forum
13 - 17 Mar 2005	11th Australian International Aerospace Congress (AIAC-11) Incorporating the 4th DSTO International Conference on Health and Usage Monitoring (HUMS 2005) http://www.dsto.defence.gov.au/corporate/conferences/hums
15 - 20 March	Australian International Airshow 2005 Avalon airport, Geelong www.airshow.net.au
17 - 19 Apr 2005	2nd Complex Adaptive Systems in Defence Workshop Canberra http://www.dsto.defence.gov.au/ssl/cas/index.html
12 Apr 2005	2005 Humanities Security and Counter Terrorism Research Forum Australian National University, Canberra, Australia http://www.safeguardingaustralia.org.au/humanities
18 - 20 Apr 2005	Networks and Communication Systems Krahi, Thailand Email: calgary@iasted.org
12 - 14 Jul 2005	2005 Safeguarding Australia Conference: The 4th Homeland Security Summit and Exposition Conference National Convention Centre, Canberra, Australia http://www.safeguardingaustraliaconference.org.au/
22 - 25 Aug 2005	8th International Symposium on Signal Processing and its Applications Sydney, Australia http://www.elec.uow.edu.au/isspa2005
4 - 8 Sep 2005	2005 European Signal Processing Conference Antalya, Turkey http://www.eusipco2005.org/
28 Sep - Oct 2005	21st Conference on Optical Communications SECC, Glasgow, UK http://conferences.iee.org/ecoc05/index.html

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